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INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY 50X1-HUM

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COUNTRY East Germany

SUBJECT Aeronautical Examination on Propulsion Technique Given in East Germany

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THIS IS UNEVALUATED INFORMATION. SOURCE GRADINGS ARE DEFINITIVE. APPRAISAL OF CONTENT IS TENTATIVE.

Attached for your information is a copy, of an examination on aircraft propulsion technique given in East Germany on 26 October 1962.

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50X1-HUM

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GROUP 1
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50X1-HUM

Next 10 Page(s) In Document Denied

50X1

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Please find attached the list of questions asked on the written exam for the superior technical officers of the DDR Aviation on 26 October 1962.

50X1-HUM

Basic Material: technique of propeller

Group I - Written Exam

Section I

1. What is the W value of the rate of total dynamic compression form the time of flight to the [redacted] (vicinity of the ground (pressure:760 mm of mercury, temperature 15°C) in normal atmospheric conditions?--The speed rises to 1080 Km/h; [redacted] Air braking takes place adiabatically and without friction.

Answer: rate of total compression= 1,66

2. How does the rate of total dynamic compression evolve between 0 and 11 km of altitude when the speed of flight is 1400 km/h and remains constant at all levels of altitude. The chart INa is to be used for calculation.

Answer: rate of total dynamic compression see page one

N.B. When a numerical fact is underlined in the text, it is because the value is not certain (difficulty in reading the original document)

3. Determine the work of adiabatic compression of the super-charger (compressor) to a fixed point--the perimeters defining exterior air are : pression 1,015 bar and temperature 15°C, the supercharger delivers a total [redacted] pressure of 8 bar.

Answer: work of diabatic compression 232.000 Nm/kg

4. Calculate the rate of compression of a supercharger whose work of adiabatic compression is 155.000 Nm/kg and the air temperature reaches 20°C?

Answer: rate of compression 4,34

5. What is, in the case of an entry of axial air, the value of the number of 'Mach' at the level of the first stage of the supercharger's eructater (belcher; aparatus to bring up wind) 111

50X1-HUM

SECRET NO FOREIGN DISSEM

x = equals sign

The (ray) at the top of the ~~[illegible]~~ plane (~~hight of dawn~~) is 0,30~~[illegible]~~ m, the absolute speed attained 130/mg and the rotation speed 8000 t/m, air temperature of 20°C admitted.

Anser: Number of 'Mach' at the entrance of the belcher: N#0,827

6. Calculate the rate of compression of an axial supercharger at seven stages during which the rate of compression of each stage alone is x equal to 1,3.

Answer: rate of compression of supercharger 6,3

7. What is the value of the compression rate ~~rate~~ reached ~~in~~ a x supercharger when the quantity of work brought to each kilogram of air rises to 200.000 Nm/kg the return (discharge) being 0,8 and the air temperature admitting 27°C?

Answer: rate of compression of supercharger 4,43

8. To drive (into mâtion) the supercharger's belcher at 5000 t/m, 2600 kw are necessary; what power ~~[illegible]~~ should one provide to make it turn at 10.000 t/m?

Answer: Necessary power to supercharger 20,6 Nw

Section II

1. Determine the minimum quantity of air required for the combustion of a kilogram, of a motor fuel composed of 80% carbon and 20% hydrogine.

Answer: minimum need of air: 16,1 hg/kg.

2. What is in the aformentioned case the effective quantity of air when the relation of lambda dilution to the exit of the chamber is 4?

Answer: effective quantity of air 64,4 hg/kg

3. What is the percentage in weight of gas in the carburated mixture with a rate of lambda dilution at 4?

Answer: the percentage of gas in the carburated mixture rises to 1,7%

4. Determine the rate of lambda dilution when the air discharge per second which crosses the motor is 50 Ng and the carburant injected is aviation petrol?

Answer: rate of lambda dilution 4,26

5. What is the rate of thermic change per volume unit of combustion chamber under the following conditions: [illegible] consumption (consommation) of carburant hourly 2500 kg/h; calorific power of carburant 46.00 hg/kg; volume of the chamber 0,206 m 3, average pressure in the chamber 4 bar?

Answer: rate of work of chamber $136,5.10^5$ kJ/m^3.h.bar.

Section III

1. Determine the speed of gas at the exit of the gas turbine distributor under the following conditions:

Quantity of heat contained in the gas at the entrance 1000 kJ/kg
at the exit 620 kJ/kg

Answer: speed of gas 600 m/s

2. What is the importance of the modification of the heat quantity contained in the gas- from the time that the passage of the gas turbine distributor for which the speed of discharge passes 165 m/s at the entrance to 590 m/s at the exit?

Answer: Dimunition of the quantity of heat withheld 160,35 kJ/kg.

3. Calculate the work of adiabatic "easing-off" of gas in a turbine when the following amounts are known: See page

Answer: work of adiabatic relaxation 29: kJ/kg

4. Determine the strength of the gas turbine when: See page 4

A Answer: strength of the turbine 11,5 NW

5. What is the value of the centrifical force which acts on each radiating plane (wing) of the "belcher" under the following conditions:

4

mass of the wing m # 0,28 kg
distance to axis from center of gravity of wing # 0,245 m
rotation speed N # 11.000 t/a

Answer: centrifical force 10,15 Mp

SECTION ₦ IV

No written questions on this material

SECTION V

1. Calculate and construct on the diagram p. v the ideal cycle of performance of a reactor working on a ₣ fixed point under the following conditions:

See page 4

Answer: Work developped in the cycle 245,44 kJ/kg
Thermo Return 0,35

2. Determine the most favorable compression rate to obtain the maximum push - charge from a reactor when: See page

Answer: most favorable rate of compression 6,11

3. Determine the internal work of a reactor when the speed of flight is VH # 1800 lm/h and the ejection speed of gas outside the tuyere (enjector nozzle) C_P # 600 m/s.

Answer: internal work 55.000 Nm/kg

4. What is the value of the internal work of a reactor functioning at a fixed point under the following conditions : see page v

Answer: Internal work 154 900 Nm/kg

5. Determine the push charge of a reactor in the case of flight to ₣ ground proximity (pH # I,013 bar) at the speed of 1200 Km/h under the following conditions: seepage 5

Answer: push 14 200 H

6. A reactor develops in performance at ₭ a fixed point a push charge of 27.000 N. Calcualte the specific consumption oof carburant under the following conditions:
See page 6

Answer: specific consumption of carburant 0,1068 kg

5

7. Dete mine the internal, exte nal and global output of a reactor flying at a speed of v_H # 1200 km/h at 8 km altitude, developping a push (charge) of S # 13.000 N, having an hourly consumtion of carburant of Mh # 1950 kg/h, an air discharge of mL # 5 P kh/ s. The carburant is a petrol (gas) which has the calorific stregth of Hs # 418.000 kJ/kg

Answer: internal output 0,262 e
external output 0,725
global output 0,190

8. Determine the global o utput of a turboreactor flying at a speed of v_H # 1200 km/h when c_D # 500/ms; C_{pm} # 1191 J/kg degree T_B # 1010°K and T_v # 540° E are given

Answer: global output about 0,141

SECTION VI

1. Determine the specific consumption of a reactor when the push (charge) S # 35.000H and the hourly carburant consumption is Hh # 3150 kg/h.

Answer: specific carburant consumption 0,09 kg/NH

2. Determing the operation which in normal conditions would have a propellor functioning under the following conditions:

air temperature varying a T_H # 20°C operation 11.500 t/m

Answer: operation under normal conditions No # 12 270 t/m

3. The air discharge by second being mL # 50 kh/s at a pressure of PH # 765 mm o of Hg and a temperature tH # 30°C, determine the air discharge under normal conditions

Answer: air discharge : 51 kg

4

4. What push (charge) does a propeller at t_H # 30°C develop to a pressure of P_H # 730 mmHg when the charge developped under normal conditions is S # 23.500 N.

Answer: push: 22.600 N

5. What is the value of the specific carburant consumption at a temperature of T_H # -25°C, when under normal conditions the specific carburant consumption rises to b # 0,106 kg/Nh?

Answer: specific carburant consumption: 0,1002 kg/Nh

6

6. A try of the propellerx at a fixed point was carried out at t_H # -25°C and p_H # 720 mmHg.at operation system N # 11.5000 t/m the propeller had a specific carburant consumption of b # 0,106 kg/Nh and developped a charge of 25.000N.

Determine the system, the specific carburant consumption and the charge under normal atmospheric conditions:

Answer: system 11320 t/m
specific carburant consumption 0,104 kg/Nh
charge 26.400

7. Among other technical attributes of a propeller, the following values are indicated:

system	N	nominal	12 000 t/m
charge	S	nominal	26 800 H
specific consumption	b	nnominal	0,102 kg/Nh

What are the values of the charge and of the specific carburant consumption when the propeller functions on the same system but at t_H # 22°C and p_H # 730 mmHg?

Answer: charge 24.450 N
specific carburant consumption 0,105 kg/Nh

8. Determine the charge of a turboreactor at 11.00 m altitude when at sea level and at the same speed, the charge of the propeller rises to 34.000 N and the charge retreived to the discharge L 500 N. s/kg?

Answer: charge at 11 km altitude 13635 N

SECTION VII

1. What gas temperature should be reached in the post conbustion nozzle to increase by combustion of supplementary carbon in the lower stream of the turbine the charge of 25.000 at 30.000 N? Before increasing the charge, the temperature behind the turbine TT # 979°k and v_H #)

Answer: temperature of gas 1400°E

2. The charge without post conbustion rises to 50.000 N for a flight speed of v_H # 1200 km/h, the air discharge being 100 kg/s. Determine the charge during flight with post conbustion when the temperature passes TT # 930°E to T_H # 1500°k by supplementary carburant conbustion.

Answer: charge with post combustion 71.500 N

3. To what value should the gas temperature rise to increase the charge from 60.000 to 100.000 N by post combustion at a flight speed of v_H # km/h, when the temperature of gasses behind the turbine without post combustion is TT # 950° K and the specific charge S/sp # 500 Nm/kg

Answer: gas temperature: 16000° K

SECTION VIII

No written questions on this material

GROUP II

No written questions of this material

GROUP III

No written questions on this material

see page 8 for Group IV

GROUP V

SECTION I

1. Determine the charge of a liqid rocket whose propogol discharge is m_T # 50 kg/s and the ejection speed of gases is C_D # 2000 m/s

Answer charge 100.000 N

2. /calculate the charge brought about from the specific consumption of propogol of a liquid rocket when the ejection speed of gasses is cD # 2500 m/s

Answer: charge 105.625 N

4. Calculate the internal return of a liquid rocket whose gas ejection speed id CD # 2000 m/s and the calorific strength of the mixture 2700 kJ/kg

Answer: internal return 0,742

GROUP IV

SECTION I

1. At a flight speed of v_H # 2000 km/h, the ejection speed of gas rises to C_D # 750 m/s, the coefficient of lambda dilution # 1, the ejected carburant is petrol. What are the values of the the charge effected by the discharge from specific acarburant consumption?

Answer: Charge in relation to discharge 194,4 Ns/kg
Specific carburant consumption 1,26 kg/N.h

2. At what number of Mach should a plane fly when the total compression rate in the case of adiabatic braking without friction rises to Pi # S in the stato-reactor?

Answer: Number of Mach of flight: 2,02

50X1-HUM